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U.S. EPA. 2014. *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries: 2014 Technical Support for Criteria Assessment Protocols Addendum.* EPA 903-R-**-***. Region III Chesapeake Bay Program Office, Annapolis, MD.

Update of the Chesapeake Bay SAV Restoration Goal: Alignment with Chesapeake Bay Water Quality Standards.

- **Spring 2014 draft text. Final work p**ending decisions across CBP in spring 2014

BACKGROUND

During 2013 and early 2014, the SAV Workgroup of the Habitat Goal Implement Team in the CBP partnership reviewed the restoration goal setting methodology (used to determine the single best year of SAV growth). The SAV Workgroup found there were differences between the 185,000 acre goal setting effort of 2003 and establishing the more recent 192,000 acre water quality standards goal. The 185,000 acre SAV restoration goal setting effort preceded Chesapeake Bay tidal water jurisdiction's adoption of the water quality criteria into their water quality standards. The standards setting process had the benefit of the analyses and summary information available from the development of the 185,000 acre goal and the published derivation of water quality criteria (U.S. EPA 2003a). An alignment of the historical goal with the present water quality standards based goal of 192,000 acres is needed.

The submerged aquatic vegetation (SAV) acreage restoration goals were developed as a larger effort to restore Chesapeake Bay water quality. In 1993 the Chesapeake Executive Council formally adopted its first SAV restoration target as the Chesapeake Bay Program's first quantitative living resource restoration goal (Chesapeake Executive Council 1993). Subsequent revision of the goal occurred coincident with providing target goals supporting the Chesapeake 2000 Bay agreement, the development of Chesapeake Bay water quality criteria (U.S. EPA 2003a) and the adoption of the regional Chesapeake Bay water quality criteria into standards by tidal bay jurisdictions of Maryland, Virginia, Delaware and the District of Columbia.

During the Chesapeake Bay Program's Criteria Assessment Protocol Workgroup's 2012-2014 review process supporting updates to water quality standards protocol assessments in support of the 2017 TMDL mid-point assessment, Chesapeake Bay Program staff reviewed the basis for the water quality clarity standard assessment protocol. Chesapeake Bay Program staff identified a difference between the 2003 SAV goal target (185,000 acres) adopted by Chesapeake Bay Program partnership and the existing SAV target acreage goal based on the sum of Chesapeake Bay water quality standards (192,000 acres). The basis, derivation, revision and adoption of the 185,000 acre bay-wide submerged aquatic vegetation acreage goal and associated assessment

protocols is provided in the U.S Environmental Protection Agency Region III's April 2003 publication of *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and its Tidal Tributaries (Regional Criteria Guidance)* and accompanying volumes of technical support documentation (U.S. EPA 2003 a, b, c). Many potential goal acreages were considered in developing the 185,000 acre goal (U.S. EPA 2003 Oct.). Subsequent to this goal being developed and adopted to support the goals of the *Chesapeake 2000* agreement, water quality standards were derived for a new shallow water designated use in Chesapeake Bay. The water quality standards goals support the Total Maximum Daily Load restoration targets. The development of the water quality standards was not, however, a direct adoption of the 185,000 acre underwater bay grasses goal when the States established their water quality standards.

The Chesapeake Bay Program partnership and its Submerged Aquatic Vegetation Workgroup assisted the Criteria Assessment Protocols Workgroup in understanding the historical basis for the differences in the two underwater Bay grass acreage restoration goal totals. A review of the details of the goal derivation methodology illustrated how the State's 192,000 acre water quality standards-based goal used the underlying details forming the 185,000 acre goal as the foundation for their standards setting. The States had the benefit of the body of history used to develop the 185,000 acre goal and all the caveats with computing that target acreage. In adopting segment specific water clarity standards the Chesapeake Bay Program partners more accurately reflected segment SAV goal acreages. The 192,000 acre goal is better aligned with the method used in the annual aerial survey of SAV to assess the status of Bay grasses and track change towards attaining water clarity/SAV goals. In order to unify the goals and acknowledge a single SAV goal acreage supporting the Chesapeake Bay TMDL, we review the history of establishing Chesapeake Bay underwater bay grass goals. We provide support for updating the Chesapeake Bay Program partnership's SAV restoration goal to match the Bay jurisdictions combined water quality standards based target of 192,000 acres.

SAV RESTORATION GOAL HISTORY IN BRIEF

The original tiered SAV restoration goal acreage targets for Chesapeake Bay were first published in the 1992 SAV technical synthesis in response to commitments set forth in the *Submerged Aquatic Vegetation Policy for the Chesapeake Bay and Tidal Tributaries* (Chesapeake Executive Council 1989). Three tiers of restoration targets were developed. The tiered set of SAV distribution restoration targets was established to provide a measure of incremental progress for Chesapeake Bay in response to improvements in water quality. The Tier I SAV distribution restoration target was the restoration of SAV to areas that were currently or previously inhabited by SAV as mapped through regional and bay-wide aerial surveys from 1971 through 1990 (Batiuk et al. 1992, Dennison et al. 1993). The Tier II and Tier III distribution restoration targets were the restoration of SAV to all shallow water areas delineated as existing or potential SAV habitat, down to the 1- and 2-meter depth contours respectively. A complete, detailed description

of the original process for developing the tiered restoration goals and targets is found in Batiuk et al (1992, pages 109-119).

In 1993 the Chesapeake Executive Council formally adopted the Tier I SAV restoration target as the Chesapeake Bay Program's first quantitative living resource restoration goal (Chesapeake Executive Council 1993). Refinements were made to the Tier I restoration goal as a result of a reevaluation of the historical SAV aerial survey digital data sets, including a thorough quality assurance evaluation, which resulted in corrections to the original data. The revised Tier I goal total was 113,720 acres. The tier I goal and the coincident goal areas for each Chesapeake Bay management segment were published in SAV Technical Synthesis II, Chapter VIII, Table VIII-1 (Batiuk et al. 2000 I think).

U.S. EPA (2003 Oct pp118). The Chesapeake Bay 2000 agreement committed to revising the existing underwater bay grass restoration goals and strategies: "*…. to reflect historical abundance, measured as acreage and density from the 1930s to present".* The basis for the goal setting acreages referred to "historical" underwater bay grass distribution as being assessed from aerial photographs from the 1930s to the early 1970s (U.S. EPA 2003 October). Single best year assessments were made on each Chesapeake Bay management segment and characterized as "historical" or designated a best year according year in the contemporary Chesapeake Bay underwater bay grass aerial survey monitoring data (1978-2000) (U.S. EPA 2003 Oct). Abundance was classified according to Chesapeake Bay management segments and depths that were designated for the new Chesapeake Bay shallow-water underwater-bay grass designated use (U.S. EPA 2003a + b(Oct 2003).

The new 2003 restoration goal of 185,000 acres was derived from the composited 1930s-2000 time series using the total single best year acreage summed over all the segment depths that were designated for shallow water bay grass use. U.S. EPA (2003 October, Table IV-12, pp114) describes the details of the methodology used in taking the combination of historical and contemporary information available and determining the revised 185,000 acre Chesapeake Bay-wide underwater grasses restoration goal. (See also U.S. EPA 2003 December Appendix A statement of 185,000 acre goal adoption consistent with the goals of Chesapeake 2000.) Goal options ranged 17-fold from a low for the area of the 1984 underwater Bay grass distribution (37,356 acres) to a high for the area represented by the total Bay shallow water habitat out to the 2-meter depth contour minus underwater acres from declared no-grow zones (640,926 acres). Pp119. U.S. EPA (2003 October) illustrated the array of different underwater bay grass and shallow water habitat acreages considered during the process for setting the shallow-water designated use depth and establishing the new Chesapeake Bay underwater restoration goals.

COMPARISON OF 185,000 ACRE AND WATER QUALIITY STANDARDS 192,000 ACRE BAY GRASSES RESTORATION TARGET COVERAGE:

During 2013 and early 2014, the SAV Workgroup of the Habitat Goal Implement Team in the CBP partnership reviewed the restoration goal setting methodology (used to determine the single best year of SAV growth). The SAV Workgroup found there were differences between the 185,000 acre goal setting effort of 2003 and establishing the more recent 192,000 acre water quality standards goal. The 185,000 acre SAV restoration goal setting effort preceded Chesapeake Bay tidal water jurisdiction's adoption of the water quality criteria into their water quality standards. The standards setting process had the benefit of the analyses and summary information available from the development of the 185,000 acre goal and the published derivation of water quality criteria (U.S. EPA 2003a). The Chesapeake Bay Program partnership used data through 2000 for its single best year assessment and considered a 2001 underwater acreage total (U.S. EPA 2003 Oct Figure IV-31) was considered as a potential goal in setting the 185,000 acre restoration target.

The 2003 goal setting approach included many cases of undercounting SAV. The undercounting was due to estimated acres of SAV with 'clipped' SAV beds within the GIS analysis. Clipped areas represented the difference between the GIS shoreline record and actual shorelines in the aerial photographs. The process of clipping these areas produced a loss of this SAV from a segment as viewed through the lens of GIS because it would be classified as SAV being 'on land' and could not have an associated bathymetry for that area. The inaccuracy of the shoreline data layer exists for multiple reasons, i.e. either because of the scale of the data, changes in the shoreline over time not reflected in the data (e.g. erosion and sea level rise) or some other factor. At the same time there was a similar problem of undercounting involved with SAV on flats around islands due to shifting shorelines. This issue is acknowledged in U.S. EPA (2004 Oct, pp92-93).

"*The chosen solution, described in more detail in U.S. EPA 2004 Technical Support Document – 2004 Addendum, was to count all of the SAV acreage for a given segment that occurred within a single best year regardless of any shoreline, bathymetry data limitations or water clarity application depth restrictions*" (U.S. EPA 2004 Oct). Further, as described in U.S. EPA 2004 Oct, we see that EPA recognizes the officially adopted SAV restoration goals but encourages the tidal Chesapeake Bay jurisdictions to consider the new information when refining and adopting new water quality standards, setting up the CBP for different goal acreages:

"*The U.S. EPA 2004 Technical Support Document – 2004 Addendum documents the 'expanded restoration acreage' updating existing use acreage and the available shallow water habitat area for each Chesapeake Bay Program segment. As described in the 2004 addendum:* "*The expanded restoration acreage is the greatest acreage from among the updated existing use acreage (1978-2002; no shoreline clipping), the Chesapeake Bay Program adopted SAV restoration goal acreage (strictly adhering to the single best year methodology with clipping) and the goal acreage displayed without shoreline or application depth clipping and including areas from SAV still lacking bathymetry data. This 'expanded restoration acreage' is being documented here and provided to the partners as the best acreage values that can be directly compared with SAV*

acreages reported through the bay-wide SAV aerial survey. ***These acreages are not the officially adopted goals of the watershed partners; they are for consideration by the jurisdictions when adopting refined and new water quality standards regulations****."*

The Chesapeake Bay Program SAV restoration goal of 185,000 acres and the segment-specific goal acreages stand as the watershed partners' cooperative restoration goal for this critical living resource community (Chesapeake Executive Council 2003). ***EPA recommends that the jurisdictions with the Chesapeake Bay tidal waters consider adopting the expanded restoration acreages…into their refined and new water quality standards regulations****.*

There were also no bathymetric data for many tidally connected ponds in the segments and SAV in these ponds was excluded. Lack of bathymetric data affected the upper portions of the Patuxent River Tidal Fresh (PAXTF) and Anacostia Tidal Fresh (ANATF) segments. The ANATF segment had no SAV, however, the lack of bathymetry in the upper Patuxent River excluded most of the known SAV acres in that area.

With respect to setting water quality standards based SAV goal acres by Chesapeake Bay management segment, U.S. EPA 2004 (Oct) further highlighted that '*Since the 2003 publication of both the Regional Criteria Guidance and the Technical Support Document, new information has become available to the watershed jurisdictions and EPA in support of state adoption of SAV restoration goal…acreages. This new information will also help the four jurisdictions with Chesapeake Bay tidal waters to adopt consistent, specific procedures for determining attainment of the shallow-water bay grass designated uses into their regulations. EPA continues to support and encourage the jurisdictions' adoption of segments-specific submerged aquatic vegetation (SAV) restoration goal acreages…necessary to support restoration of those acreages of SAV into each jurisdictions respective water quality standards regulations.*" After the 185,000 acre restoration goal was set, 2002 data for underwater bay grass aerial surveys became available to support decision making for establishing standards.

THE WATER QUALTIY STANDARDS-BASED SAV GOAL ACREAGE.

The Chesapeake Bay SAV WG, and Chesapeake Bay Program staff determined that the basis for the 185,000 acres goal formed the foundation for the 192,000 acre water quality standards based goal. As recommended by EPA, the original Chesapeake Bay underwater grasses goal acreages by segment and the expanded restoration acreages were used. With few exceptions around the Bay, the water quality standards segment goals for SAV acres are equal to or greater than the segment acreage goals supporting the 185,000 acres. The jurisdictions were consistent in their consideration for adding back previously missing acres in management segment goals due to GIS-related clipping of SAV acres. Most of these 'clipped' acres were previously considered as 'on land' even though they were clearly visible in the aerial photographs identifiable between the GIS layer land boundary and the visible shoreline of the photographs. Additional excluded acres had previously missing bathymetry or were segments without established goals (Table "X").

This table uses the split segments as individual segments. It is a comparison of WQS acres to the 2003 CBP SAV Restoration Goal Segment Acres. Segment total = 104. In 2003 the CBP recognized 104 segments according to U.S. EPA (2008). Appendix X provides a more detailed table that accounts for the decisions made in the assigning of goal acres to segments.

Table X. Summary of the decision-support underlying the Chesapeake Bay water quality standards acreages developed by the jurisdictions.

Goal acreage basis for Water Quality Standards	192,000 acre goal using U.S. EPA 2003 Segment Count 104 Management Segments	192,000 acre goal using U.S. EPA 2008 Segment Count TMDL basis: 92 Management Segments
Segments where WQ Standards acres are **GREATER THAN or EQUAL TO** the original 2003 CBP 185K SAV goal basis[1]	95 (91.3%)	85 (92.4%)
Segments where acreages were **LOWER** than the 2003 185K CBP goals basis[2]	9 (8.7%)	7 (7.6%)

1. Note: Segment goals for C&D and Anacostia: C&DOH_MD 7 acres C&DOH_DE 0 acres ANATF_MD 0 acres ANATF_DC 6 acres are no longer listed as segments without goals (3/10/14 R. Golden email) and included in this accounting.
2. Lower acreages can be a function of model derived goals or refined habitat assessments in split segments.

The final goal is the water quality standards based acreage (192K) which is a function of the original 185K CBP restoration goal. There is more aggressive accounting for acres and the 192K goal reflects the present water quality standard measurement process better than the basis for the 185,000 acre restoration goal.

"192,000" ACRE WATER QUALITY STANDARDS-BASED GOAL RECOMMENDATION

The 185,000 acre SAV restoration goal was a conservative target affected by undercounting SAV acres in a subset of Chesapeake Bay management segments. Undercounted acres were due to multiple factors included mismatches between shoreline data layers and present day shorelines that resulted in SAV 'on land' that was actually in the water or missing bathymetry (e.g., PAXTF). The 192,000 acre goal is the sum of water clarity acre standards for Bay states and DC where segment goals were developed supporting water quality standards attainment equal to or greater than the CBP restoration acreages used for each segment when creating the original 185,000 acre SAV restoration target.

Recognizing that there are still segments without goal acreages, the "192,000" acre goal should be stated as "The Water Quality Standards-Based Goal", where the acreage total remains subject to goals being set segments without goals at this time. The SAV WG could work to develop SAV acreage goals. The basis of the goal is firmly established in the underlying support developed for the 185,000 acre goal and the additional information provided to the community upon further analysis of the data. Second, the 192,000 acres goal reflects more accurately how the water quality standards attainment assessments are conducted, tracked and reported than is the 185,000 acre goal.

CONSIDERATIONS FOR FUTURE ACREAGE GOAL AND PROTOCOL ASSESSMENT CONSISTENCY

Future consideration could be given for additional consistency between states in their basis of setting their water quality standards where all jurisdictions only go out to application depth (the Maryland model) or they extend out to include the deep water acres (the Virginia model). If MD adopted the VA model, the additional deep water acres would increase the 192,000 goal by about 14,000 acres to 206,000. Further, there are additional considerations that could be given to support an even larger goal (See Table X acreages). The SAV WG has been funded in 2014-15 to produce and SAV Technical Synthesis that updates the science, management and assessment of SAV and its habitat. This publication could support a future review regarding any needs to amend the water quality criteria and subsequently standards for the four tidal Chesapeake Bay jurisdictions.

Literature Cited

Chesapeake Executive Council 1993.

USEPA (U.S. Environmental Protection Agency). 2003a. *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries*. EPA 903-R-03-002. U.S. Environmental Protection Agency, Region 3, Chesapeake Bay Program Office, Annapolis, MD.

USEPA (U.S. Environmental Protection Agency). 2003b. *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability*. EPA 903-R-03-004. U.S. Environmental Protection Agency, Region 3, Chesapeake Bay Program Office, Annapolis, MD.

USEPA (U.S. Environmental Protection Agency). 2004a. *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries. 2004 Addendum*. EPA 903-R-03-002. U.S. Environmental Protection Agency, Region 3, Chesapeake Bay Program Office, Annapolis, MD.

APPENDIX X. SAV under development